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REMARKS/ARGUMENTS

The Examiner noted applicant's election of Group I claims for examination, and indicated that claims 25-31 and 34 had been withdrawn from further consideration. In response all of the withdrawn claims, claims 25-31 and 34 are being cancelled without prejudice, with the exception of claims 28 and 30. Claims 28 and 30 are being amended to make them dependent from claim 3, so that they now may be properly included within the Group I claims.

The Examiner noted that the Oath or Declaration was defective. A replacement Declaration is included, properly identifying the application by serial number. The Examiner's comments on the Information Disclosure Statement are noted.

With respect to the specification, the Examiner noted a number of minor corrections required to pages 9, 11 and 13. These corrections are being entered.

Additionally, minor amendments are being made to the paragraph at page 8, lines 19-24, to ensure proper use of the reference numerals in the drawings, in particular reference numerals 116, 118 and 200a.

With respect to the drawings, the Examiner objected to the drawings under 37 C.F.R. 1.82(a), on the grounds that the drawings must show every feature of the invention specified in the claims. In particular, the Examiner argued that the feature of "each reaction chamber being in fluid communication with an adjacent one of the plurality of reaction chambers and each coolant chamber being in fluid communication with an adjacent coolant chamber" must be shown, quoting this passage from claim 9. In response and as detailed below, it is submitted that this feature is adequately shown in the drawings. The reactor plates are described in relation to Figures 1b, 2 and other figures as having inlets and outlets 236, 237, 240 and 241 for the coolant and the reaction solution. It is also well described that the reactor vessel could have a plurality of reactor plates and separator plates, stacked together alternating with one another. The inlets and outlets 236, 237, 240 and 241 (and corresponding inlets and outlets 336, 337, 340 and 341 of the separator plate 300 (Figure 5)) essentially provide manifolds extending through the stack of plates and perpendicular to the plates, to provide the necessary connections. Thus, the solution inlets and outlets 236, 237, etc. provide

manifolds that are connected to the solution flow fields of each reactor plate; correspondingly, the coolant inlets and outlets 240, 241, etc. are connected to the coolant flow fields of each plate. The details of the connections between the inlets and outlets and the various flow fields are clearly shown in the drawings of Figures 2 and 3.

Accordingly, it is submitted that the drawings as they stand provide a more than adequate description of this aspect of the invention, and that no drawing correction is required.

With respect to the objection to Figure 8 under 37 C.F.R. 1.84(p)(5), this drawing has been amended to provide the reference 360.

With respect to the objection to the drawings, under the same rule, the Examiner noted references 116 and 118 in Figure 1a and 311 in Figure 6 that were not apparently referred to in the specification. The specification is being amended to refer to references 116 and 118; Figure 6 is being amended to delete the reference to reference 311.

Finally, with respect to the drawings, the Examiner argued that the reference character 250 in Figure 1a was used to designate both a rim and an external wall of the reactor stack. This argument is not understood. Reference 250 is used solely to designate a rim.

Turning to the Examiner's objections to the claims, the Examiner noted that claim 8, as originally worded, was dependent from itself, and accordingly did not treat claim 8 and its dependent claims 12 and 13 further on the merits. Claim 8 is being cancelled and the subject matter of this claim is being introduced into claim 1, so that no further amendment is required.

With respect to claim 33, the proposed amendment, to have this claim referred to "the coolant supply means" is being entered.

Turning to the claim rejections, the Examiner rejected claims 1-7, 9-10 and 14-21 as being anticipated by Lippert et al. The Examiner further rejected claim 11 as being obvious under 35 U.S.C. 103(a), in view of Lippert et al. and further in view of Ashmed et al. Claims 22-24 were rejected under 35 U.S.C. 103(a) over Lippert et al. and further in view of Pellegri et al. or Godec et al. Claims 32 and 33 were rejected

under 35 U.S.C. 103(a) over a combination Lippert et al. in view of Jung et al., and further in view of Amendola et al. and Anderson et al. respectively.

In response to these various rejections, claim 1 has been amended by, in effect, introducing the features of claims 8, 9 and 10. Additionally, as detailed below, details of the gasket configuration have been introduced into claim 1, without adding new subject matter. Accordingly, claim 1 as amended does not correspond, exactly, with any previously presented claim. Accordingly, it is submitted that none of the arguments presented by the Examiner are directly applicable to amended claim 1 and its dependent claims, and for this reason detailed arguments concerning all aspects of the rejections as listed are not presented. Rather, arguments are set out below concerning those aspects of the rejections still believed applicable to the amended claims. This action is being taken without prejudice.

Firstly, to summarize the amendments to claim 1, the following, in summary form, are the key amendments made to claim 1:

(1) It is now required that the reactor vessel have a plurality of reaction chambers and a plurality of coolant chambers, these two types of chamber alternating with one another;

(2) The reactor plate of each reaction chamber is provided with a solution flow field on its first face and a coolant flow field on its second face;

(3) (Corresponding to the subject matter of cancelled claim 9) It is specified that the reaction chambers are in fluid communication with one another, as are the coolant chambers. This feature flowing from the provision of the manifolds extending through the stack of plates;

(4) (Corresponding to cancelled claim 10) The inlets and outlets in the separator and reactor plates are aligned with one another to provide for supply of solution and coolant to their respective reaction coolant chambers and collection and return of the solution coming from those chambers;

(5) It is now specified that each reactor plate includes gasket grooves on the first and second faces of the respective plate with the gaskets being provided between pairs of reactor and separator plates, to form the necessary seals, to close off the reaction solution chambers.

It will be recognized that all the features listing above can be found in the previously submitted claims, principally claims 1, 9 and 10, with the exception of the last mentioned feature number (5). This feature is clearly disclosed in the specification, with reference to Figures 2, 3 and 4 in particular. There it is disclosed that gasket grooves 251, 252 are provided in each reactor plate, for gaskets 400, 401. Accordingly, no new matter has been added.

A significant feature of this arrangement is to provide a simple, effective and economical reactor vessel having a number of advantages. Firstly, both the solution and coolant channels are provided on reverse sides of the same plates, i.e. the reactor plate in each case. This ensures good heat transfer characteristics and enables rapid response times to be provided.

The arrangement with the openings in the plates providing manifolds that distribute the fluids to the various chambers again provides a simple and economical structure. It gives a compact arrangement in which both the reaction or solution flow channels, with the necessary catalyst, and also the coolant channels, can have a large surface area, within a relatively small volume.

Significantly, it is now specified that gasket grooves are provided in the reactor plates. This means that all the complicated channels, for gaskets, flow of fluids, etc., are provided in one side of each plate. This means that the separator plates are simpler. Indeed, the separator plates can be plain plates. It also avoids any problem of trying to ensure accurate alignment of, for example, a set of flow channels cut on one side of a reactor plate and a sealing groove for a gasket formed on a facing surface of a separator plate. With a gasket groove and the flow channels both formed on one side of each reactor plate, this problem of alignment is completely eliminated.

Accordingly, this arrangement provides a compact and simple arrangement that can enable rapid generation of hydrogen from a hydride solution.

Dealing with Examiner's individual concerns, the Lippert et al. reactor is apparently concerned with a wholly different type of reactor. It is specified as a "catalytic reactor", and the details of its intended use are sketchy. More specifically, the prime thrust and teaching of the Lippert et al. proposal is to use solder to join the various plates together. This is a wholly different sealing technique, and can only be used where

metal foils and the like are used, which are all formed from a metal capable of being joined by soldering and capable of withstanding the temperatures encountered. In contrast, where one is concerned with a hydrogen generation system based on a hydride solution, not all the materials involved may be able to accept temperatures required for soldering.

Significantly, since a soldering technique is used, the whole issue of aligning gaskets in a compact configuration is simply not addressed in Lippert et al. Accordingly, it is submitted that this feature alone is clearly not taught.

Lippert et al. is also noteworthy for being entirely silent on the issue of providing fluid communication to the various chambers. While the Examiner referred to various passages in Lippert et al. as teaching the fluid communication between reaction chambers, no detail is given as to how this would be achieved. Similarly, no details are given as to how distribution ducts or manifolds could be formed.

The Examiner cited Ashmed et al. for establishing the equivalency of clamping, welding and soldering as joining methods for a reactor vessel. It can be noted that Ashmed et al. is concerned with an entirely different field, namely an integrated chemical processing apparatus. The disclosed embodiment has a complex structure with numerous different layers, and is much more complex than the relatively simple construction proposed by the present invention; in the present invention, just two different types of plates alternate with one another, between necessary end plates and the like. Again, Ashmed et al. fails to teach a simple arrangement in which all of the necessary channels and grooves or gaskets are formed in one plate, i.e. the reactor plate, with alternating separator plates being claimed.

With respect to claims 22-24, the Examiner relied upon the disclosure in either Pellegri et al. or Godec et al. for teaching the provision of diagonally opposite inlet and outlet openings, configured to provide the fluid connections for the solution and coolant flow fields. This argument is respectfully traversed. Pellegri et al. is concerned with a bipolar separator for an electrochemical cell. Again, the whole issue of sealing the cell is nowhere properly addressed in Pellegri et al. As to Godec et al., this is concerned with a non-analogous and different technology, namely a reagentless oxidation reactor. As Figure 1 of this patent shows, it has an ultraviolet lamp and housing 10, a fused silica

window 14, a wire-mesh anode 16, a sample chamber 18, a bielectrode 20, a second sample chamber 22 and a stainless steel pressure plate 24. Such a structure is quite different from the present invention. Again, the whole issue of sealing and providing a sealing groove on the same plate as flow channels, to ensure accurate alignment, is not taught in this reference.

With respect to claim 32, the Examiner relied upon the disclosure in Jung et al. or Amendola et al. While these two references may be concerned with the hydrogen generation system, there is simply no reason or basis in this art to consider incorporating the teaching of either one of them into the teaching of Lippert et al. Lippert et al. is concerned with a wholly different type of reactor, and importantly teaches the provision of a large number of relatively small channels. As is well known in this art, in a chemical hydride hydrogen generation system, at various times in the cycle, the solution used may in fact be present in the form of a slurry with a significant solids content.

Accordingly, it would not be obvious to a skilled person to immediately consider using the reactor in Lippert et al. There would be concerns that the small channels in Lippert et al. would become clogged by the slurry used. Rather, conventional teaching is to use relatively large channels, to ensure the channels remain free from clogging etc.

The Examiner did refer to the passage at page 4, lines 14-33 of Lippert et al. (the published PCT application) for teaching the introduction of hydrogen to be used in fuel cells. This passage appears to correspond to column 2, lines 44-59 of the issued US patent. There, there is just a reference to producing a hydrogen-rich gas by water vapour reformation and/or partial oxidation. Such reactions are quite different, in that they involve solely gases, and possibly liquids; importantly, there would never be any solids present so there would be no danger of forming a viscous slurry which may tend to clog pores and channels. Accordingly, the Examiner has failed to make a proper prima facie obviousness rejection based on Lippert et al. and Jung et al or Amendola et al.

With respect to claim 33, the Examiner argued that it would have been obvious to control the temperature of the hydride solution. The Examiner acknowledged that even the notional combination of references (Lippert et al. in view of Jung et al. or Amendola et al.) did not disclose temperature control by control of at least one of the temperature

and the flow rate of the coolant flow through the coolant chamber. Accordingly, the Examiner relied upon the Anderson reference for providing this missing element. It is noted that the Anderson reference is again concerned with a wholly different field, which it is submitted is non-analogous. Accordingly, it is submitted that the Examiner has failed to make out a proper prima facie case of obviousness.

Accordingly, in view of all the amendments entered and arguments set out above, the claims as they stand are patentable over all the known art, and early review and allowance are requested.

Respectfully submitted,

BERESKIN & PARR

By 

H. Samuel Frost
Reg. No. 31,696
Tel: 416-957-1687

Attachments

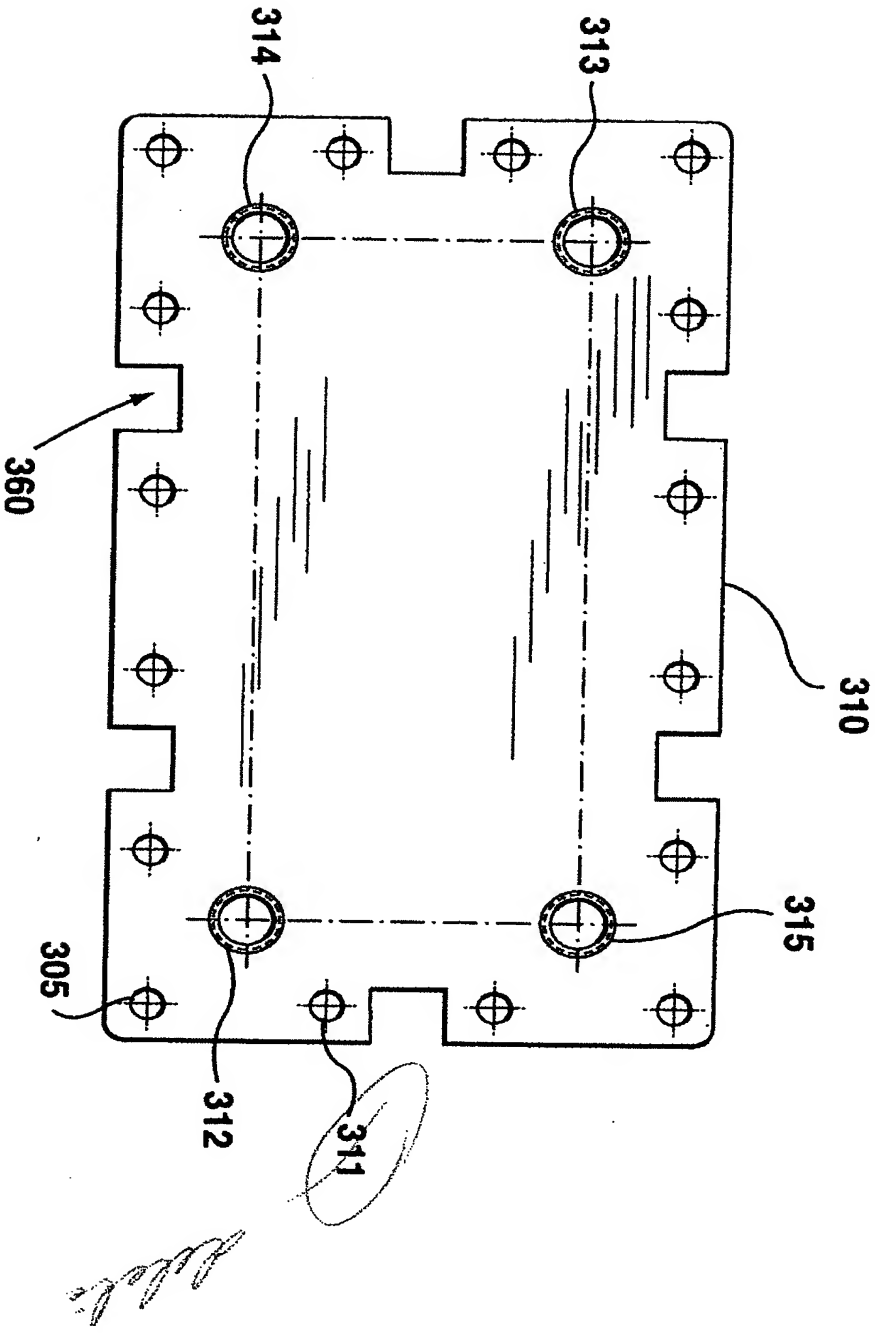

FIG. 6

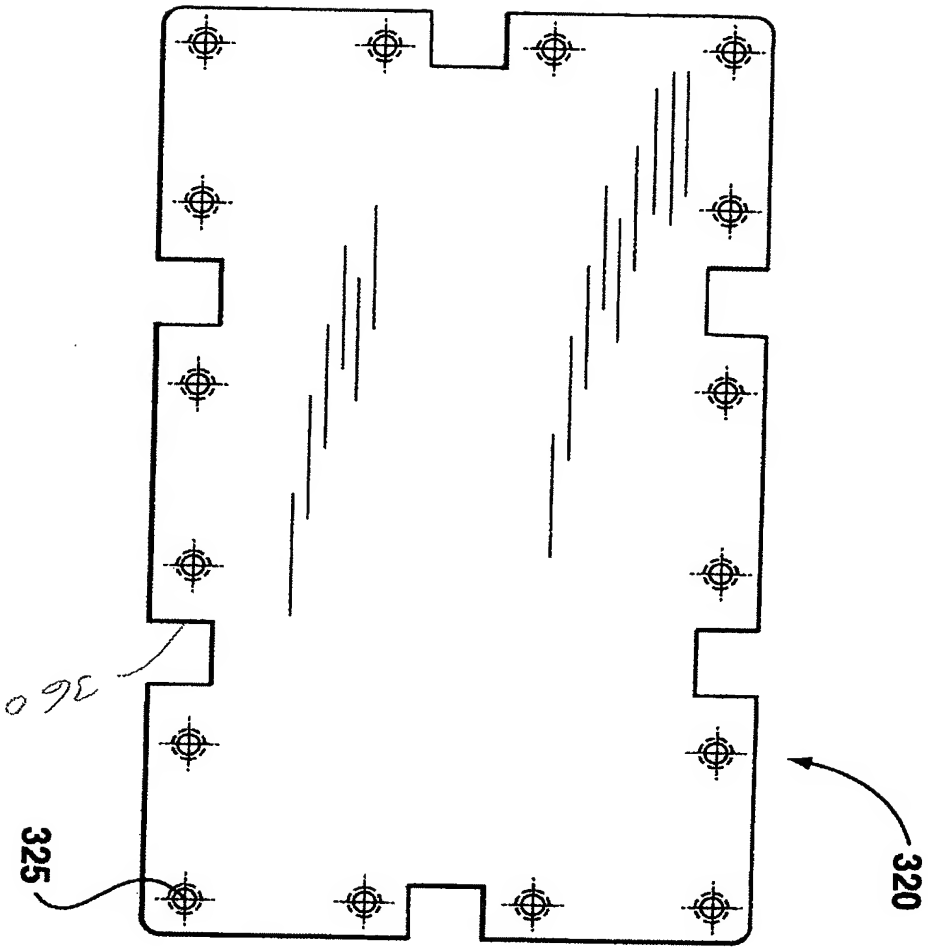

FIG. 8